

E 1.28. SOLAR 12017 - 79/04 ✓

12/15/18

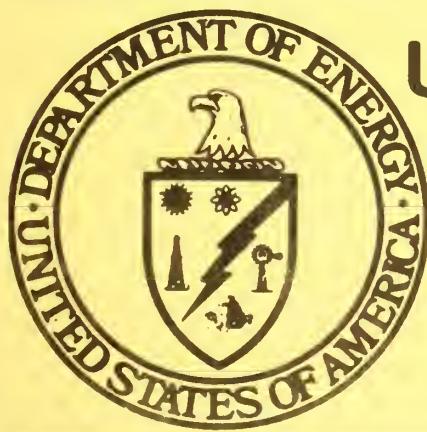
SOLAR/2017-79/04



Monthly Performance Report

ALABAMA POWER COMPANY

APRIL 1979



U.S. Department of Energy

National Solar Heating and
Cooling Demonstration Program

National Solar Data Program

NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

MONTHLY PERFORMANCE REPORT
ALABAMA POWER COMPANY
APRIL 1979

I. SYSTEM DESCRIPTION

The Alabama Power Company solar energy site is a two and one-half story commercial office building located in Montevallo, Alabama. The building has a floor area of approximately 17,000 square feet. The solar energy system is designed to provide 57 percent of the annual domestic hot water and space heating demands and up to 18 percent of the annual space cooling demand.

The collector subsystem includes four rows of flat-plate double glazed collectors. The gross area of the collectors is 2,340 square feet. The collectors are supplemented by two types of reflectors. The rear three rows of the collectors have facing mirrors sloped at 45 degrees from the horizontal while the collectors are sloped at 30 degrees from the horizontal, facing south. All four rows of collectors have vertical mirrors mounted at the tops of the collector frames. The total area of the sloped reflectors is 2,250 square feet and the total area of the vertical reflectors is 740 square feet. The collection transport fluid is water and a drain-down method of freeze protection is used. An 8,000 gallon tank is used to store solar energy.

Domestic hot water (DHW) preheating is accomplished by means of a heat exchanger tube passing through the solar storage tank. Solar preheating is supplemented, as required, by a 120-gallon electric water heater.

There are seven independently controlled heating/cooling zones. Each zone is supplied by its own air-handling unit. The air-handling units have both hot and cold water lines to allow each unit to be used and controlled independently of the other six parallel units.

Space heating is provided by pumping water from the solar storage tank through heating coils in the air-handling units. The water from solar storage is passed through an electric auxiliary boiler prior to entering the coils of the air-handling units. If the water temperature in the

solar storage tank is too low to meet the heating demand, the electric boiler is used to provide additional heating to the water, as required.

Solar energy used in cooling is provided by passing water directly from the collectors to the generator section of a 25-ton absorption chiller. Auxiliary cooling is provided by a 30-ton electric reciprocating chiller which is used in parallel with the absorption machine. An 8,000-gallon chilled water storage tank is also included in the system. This chilled water storage tank can be supplied by the absorption machine or by the reciprocating chiller during off-peak hours.

The system, shown schematically in Figure 1, has four modes of solar operation.

Mode 1 - Collector to Storage: This mode is enabled by a time clock during daylight hours and it is entered when the temperature of the water at the collector outlet exceeds the temperature of the water in the solar storage tank by approximately 10°F. This temperature differential is adjustable and is to be adjusted for optimum performance based on operational experience. The mode is terminated when the collector outlet temperature no longer exceeds the storage tank temperature by the adjusted value or when the time clock disables the mode logic.

Mode 2 - Collector to Cooling: This mode is entered out of Mode 1 when the collector outlet water temperature reaches or exceeds 165°F. Water from the collectors is diverted directly to the generator section of the absorption chiller before returning to solar storage. Evaporator outlet water is passed to the cooling coils in the air handlers whenever a cooling demand exists. If no cooling demand exists during this mode, the chilled water from the absorption machine passes into the chilled water storage tank. In this mode, the adsorption machine functions in parallel with the electric chiller to supply the building cooling load. Since heating and cooling are independently controlled by each zone, it is possible to have this mode and Mode 3 active simultaneously. The mode is terminated when the absorption machine generator inlet water temperature drops to 157°F.

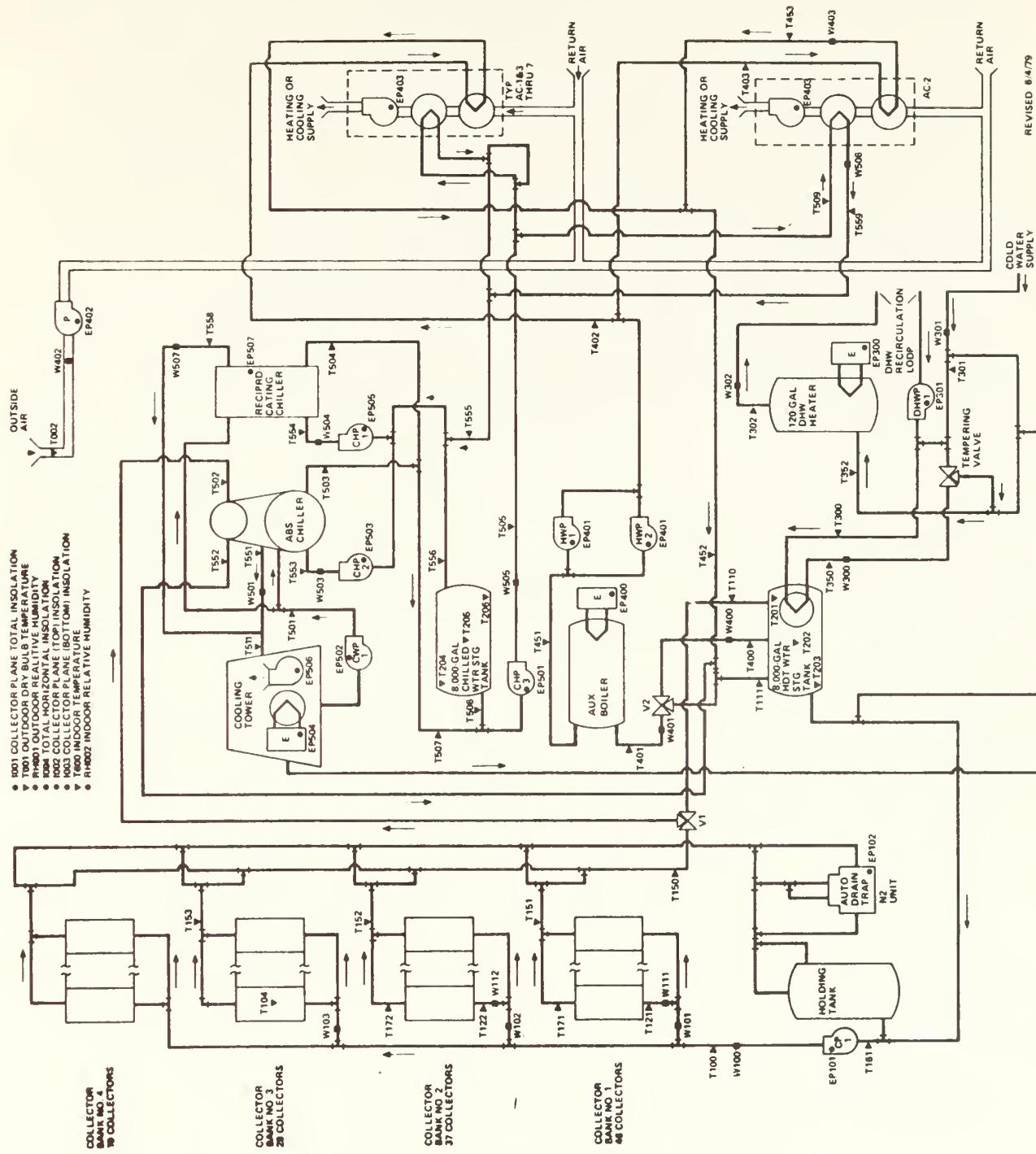


Figure 1. ALABAMA POWER SOLAR ENERGY SYSTEM SCHEMATIC

Mode 3 - Storage to Space Heating: This mode is initiated when a demand for space heating occurs at any of the independently controlled heating/cooling zones or when the outdoor air temperature drops below 65°F. Water from the solar storage tank is pumped through the auxiliary boiler, out to the air handling units and returned to storage. If the temperature of the water in the solar storage tank is above the limit value of 140°F, blending of solar storage water and space heating return water occurs to maintain a boiler inlet water temperature below 140°F. The minimum control temperature for space heating supply is varied with outside air temperature. When the outside air temperature is 65°F, the minimum space heating water temperature is 80°F. When the outside air temperature is 25°F, the minimum space heating water temperature is 120°F. The boiler is activated, as required, to maintain the minimum space heating temperature according to the control temperature just described. If the solar storage tank temperature is below the temperature of the space heating return water, the solar storage tank is bypassed by the return water. This mode can be active simultaneously with Mode 2 since heating and cooling demands are independently determined by each of the heating/cooling zones.

Mode 4 - DHW Preheating: This mode is accomplished independently of the other three solar modes. Incoming city (makeup) water and recirculation return water are passed through a U-tube heat exchanger in the solar storage tank when the temperature of the water in storage exceeds the DHW heat exchanger inlet water temperature. From the heat exchanger the water returns to the 120-gallon DHW tank which contains an electric auxiliary heating element to supplement the solar preheat. Water from the DHW tank is continuously recirculated through the building's hot water lines and returned to the DHW tank via the heat exchanger or directly.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data.

The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The Alabama Power Company solar energy site was in operation during the entire month of April. The solar energy system supplied approximately 17 percent of the combined loads for DHW, space heating and space cooling. Space cooling was the primary load for the month but none of this load was supported by solar energy since the solar heated water was not hot enough to support absorption cooling.

B. Weather

The average ambient temperature for April was 63°F with an average daytime ambient temperature of 66°F. The long-term average temperature for April is 63°F for the Birmingham, Alabama area. With these mild temperatures, the heating and cooling loads are expected to be small for April. The total incident insolation on the collector array was 102.7 million Btu for an average of 1,415 Btu/ft²-day. This was below the April average of 1,834 Btu/ft²-day derived from long-term data for the Birmingham area.

C. System Thermal Performance

Collector - Of the 102.7 million Btu of solar energy incident upon the collector array during April, 39.77 million Btu were incident when the collector pump (CP1) was operating. The system produced a net collection of 13.00 million Btu, which was 13 percent of the total incident radiation. The net collection of 13.00 million Btu was the result of 15.22 million Btu measured gain through the collectors reduced by a measured rejection of 2.31 million Btu. The relatively high level of energy rejection through the collectors was the result of frequent operation of the collector pump at times when insolation was too low for collection. The operating energy (collector pump power) for the collector subsystem was 1.54 million Btu during April.

Energy Collection and Storage Subsystem - The energy collection and storage subsystem (ECSS) includes the collector array, the solar storage tank and the lines connecting these elements to each other. The ECSS is connected to the load subsystems by supply and return lines. Figure 2 illustrates the ECSS and its energy flow paths. The net input to the ECSS through the collectors was 12.91 million Btu (15.22 million Btu collected, less 2.31 million Btu rejected). The output from the ECSS to the load subsystem connecting lines was 3.89 million Btu. Therefore, the total loss of energy from the connecting lines and solar storage tank was 6.92 million Btu.

Storage - The measured input to the solar storage tank was 15.22 million Btu while solar energy was being collected. The total measured output from the solar storage tank was 6.27 million Btu. The measured temperature in the solar storage tank indicated an increase of 2.10 million Btu in stored energy for the month. Therefore, the calculated loss through the walls of the storage tank was 6.85. This leaves 0.07 million Btu in ECSS line losses to make up the remainder of the 6.92 million Btu total ECSS losses.

Domestic Hot Water Load - The DHW load calculation is based on the flow through the DHW heat exchanger and the temperature difference between the outlet and inlet of the DHW heat exchanger plus the auxiliary electrical energy input to the DHW heater tank. The average temperature maintained at the DHW tank outlet was 103°F during April. Due to collector damage during the winter the recirculation pump EP300, which normally runs continuously, was shut off for April. This was done to prevent thermal siphoning from the 120-gallon DHW tank. Also, pump EP300 was turned on periodically to heat the water in the DHW tank. Consequently, of the 0.93 million Btu DHW load, only 15 percent, or 0.14 million Btu, was supplied by solar energy.

Space Heating Load - The total measured space heating load for April was 5.25 million Btu, of which 3.56 million Btu, or 68 percent, were supplied by solar energy. The remaining 1.69 million Btu were supplied by the

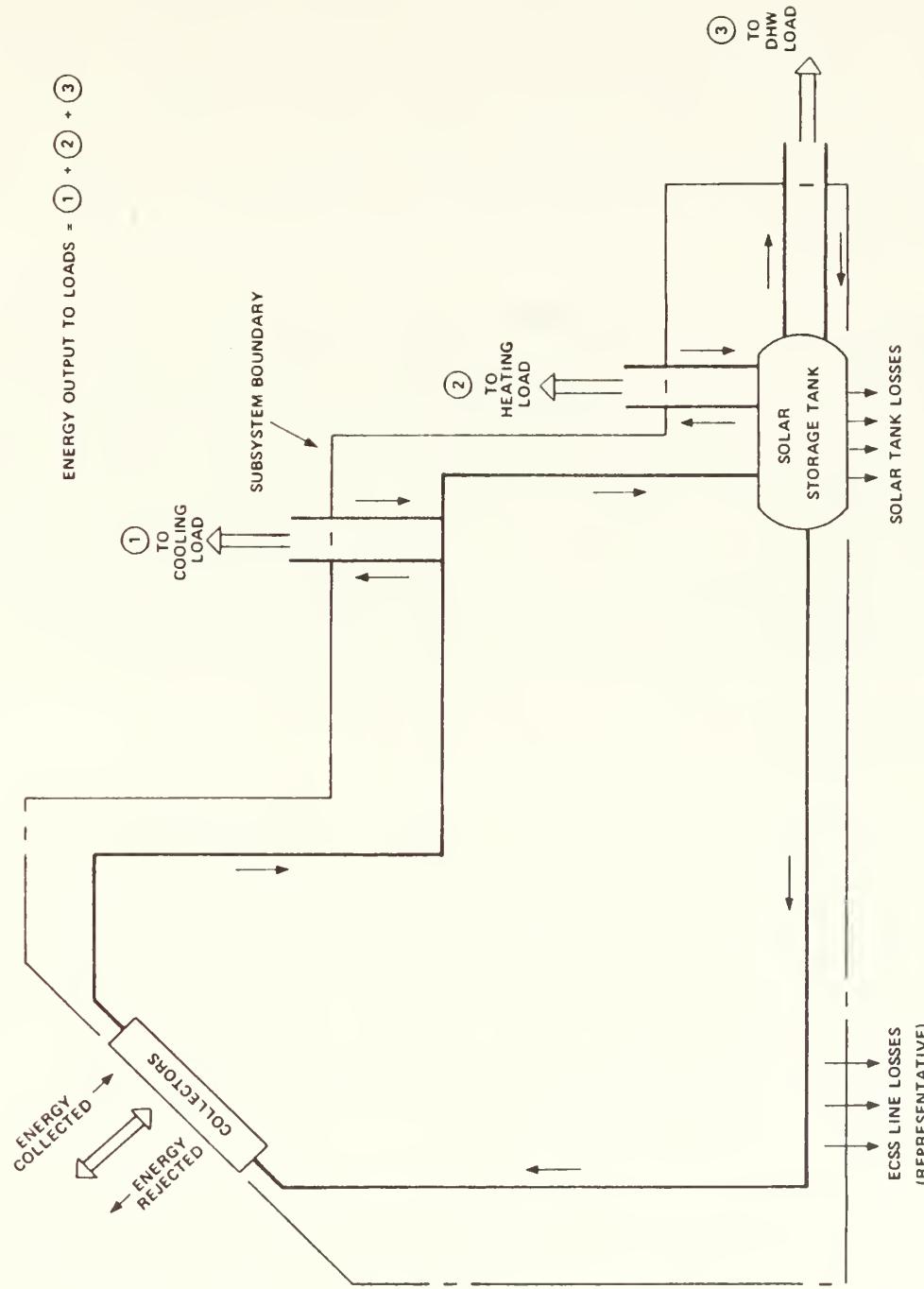


Figure 2. ALABAMA POWER COMPANY ECSS ENERGY FLOW SCHEMATIC

electric boiler. The total operating energy for the space heating subsystem was 1.07 million Btu of which 0.10 million Btu were charged directly to the solar energy system. The operating energy charged directly to the solar energy system was the pro-rata share of the circulation pump (HWP1, HWP2) power required to circulate the heated water through the space heating subsystem. Power to operate the air-handler fans was not charged against solar energy since that power would have been required regardless of whether a conventional or solar energy system was used.

Space Cooling Load - The total space cooling load for April was 42.81 million Btu. A negligible amount of this load was supported by solar energy due to the low temperature of the solar heated water available at the absorption chiller generator inlet. The absorption chiller was active on one day for a short period of time and the operating energy for space cooling charged to the solar energy system was 0.002 million Btu. The operation of the auxiliary electric chiller is summarized in the table entitled "Auxiliary Thermodynamic Conversion Equipment."

D. Observations

A significant penalty was imposed on the solar energy system by the high percentage of energy rejected through the collectors. Due to the damaged collectors, the space heating mode of solar energy system suffered considerably, along with the space cooling mode, since the water temperature in the storage tank was not raised sufficiently to supply either need. Control system improvements and basic repairs are needed to optimize solar energy collection and minimize rejection of energy through the collectors.

The seemingly high energy losses in the hot water storage tank are due to two factors. The first is the expected losses from the tank with two inches of polyurethane insulation. This calculates to be approximately 3.3 million Btu. Secondly, due to the placement of the collector control

sensor, collector pumps were activated every half-hour in the morning to determine an accurate collector outlet temperature. During the course of the month, this resulted in a rejection of approximately 3.5 million Btu of energy from the storage tank.

E. Energy Savings

A total electrical savings of 2.01 million Btu was calculated for the Alabama Power Company solar energy system. The savings calculations for DHW and space heating are based on the assumption that all load support provided by solar energy would have been provided by an equal amount of electrical energy. This load support is reduced by the amount of operating energy charged to solar hot water heating and solar space heating. The space cooling savings are calculated by obtaining the quotient of the load supplied by the absorption chiller divided by the coefficient of performance of a typical electric chiller (2.8) and subtracting the operating energy charged to solar (absorption) cooling. The total system savings is then calculated by summing the subsystem savings and reducing that sum by the amount of operating energy required by the ECSS.

III. ACTION STATUS

None.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: ALABAMA POWER COMPANY, MONTFALLC, AL
REPORT PERIOD: APRIL, 1970

SOLAR / 2017-79/04

SITE/SYSTEM DESCRIPTION:

ALABAMA POWER SOLAR SYSTEM PROVIDES SUPPORT TO SPACE HEATING, SPACE COOLING AND DOMESTIC HOT WATER SYSTEMS. SOLAR HEATED WATER IS UTILIZED TO DRIVE AN ABSORPTION CHILLER WHICH ASSISTS AN ELECTRIC POWERED CHILLER IN PROVIDING SYSTEM COOLING WATER. HEATED WATER IS STORED IN AN 8000 GALLON CAPACITY TANK. WATER CONTINUOUS RECIRCULATION LOOP INCLUDES FLOW THROUGH A HEAT EXCHANGER LOCATED INSIDE THE STORAGE TANK.

GENERAL SITE DATA:
INCIDENT SOLAR ENERGY

COLLECTED SOLAR ENERGY

AVERAGE AMBIENT TEMPERATURE	50.254
AVERAGE BUILDING TEMPERATURE	69
EXCESS SOLAR CONVERSION EFFICIENCY	3.561
EXCESS OPERATING ENERGY	1.072
TOTAL SYSTEM OPERATING ENERGY	1.693
TOTAL ENERGY CONSUMED	1.707

SUBSYSTEM SUMMARY:

LOAD	HOT WATER
SOLAR FRACTION	0.934
SOLAR ENERGY USED	15
OPERATING ENERGY	0.135
AUX. THERMAL ENERGY	0.084
AUX. ELECTRIC FUEL	0.703
AUX. FOSSIL FUEL	0.793
ELECTRICAL SAVINGS	N.A.
FOSSIL SAVINGS	0.135
	N.A.

SYSTEM PERFORMANCE FACTOR:

* DENOTES UNAVAILABLE DATA

② DENOTES NULL DATA

N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USFRC'S GUIDE TO THE MONTHLY PERFORMANCE REPORT
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,
SOLAR/0004-78/1q

102.658	MILLION RTU
4.3871	BTU/SQ.FT.U
12.987	MILLION RTU
5.550	BTU/SQ.FT.
63	DEGREES F
77	DEGREES F
0.04	
1.527	MILLION RTU
67.602	MILLION RTU
95.257	MILLION RTU

49.383	MILLION RTU
42.812	MILLION RTU
0.092	PERCENT
3.883	MILLION RTU
67.692	MILLION RTU
11.344	MILLION RTU
15.281	MILLION RTU
2.006	MILLION RTU
N.A.	MILLION RTU
0.075	MILLION RTU
N.A.	MILLION RTU

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL, 1979

SITE/SYSTEM DESCRIPTION:

ALABAMA POWER SOLAR SYSTEM PROVIDES SUPPORT TO SPACE HEATING, SPACED COOLING AND DOMESTIC HOT WATER SYSTEMS. SOLAR HEATED WATER IS UTILIZED TO DRIVE AN ABSORPTION CHILLER WHICH ASSISTS AN ELECTRIC POWERED CHILLER IN PROVIDING SYSTEM COOLING WATER. HEATED WATER IS STORED IN AN 8000 GALLON CAPACITY TANK. THE DOMESTIC HOT WATER CONTINUOUS RECIRCULATION LOOP INCLUDES FLOW THROUGH A HEAT EXCHANGER LOCATED INSIDE THE STORAGE TANK.

GENERAL SITE DATA:
INCIDENT SOLAR ENERGY

COLLECTED SOLAR ENERGY

AVERAGE AMBIENT TEMPERATURE	AVERAGE BUILDING TEMPERATURE	AVERAGE SOLAR CONVERSION EFFICIENCY	PERCENT OPERATING ENERGY	TOTAL SYSTEM OPERATING ENERGY	TOTAL ENERGY CONSUMED
55.543	68	70.757	1.131	1.786	1.900
0.015	0.142	0.089	0.827	0.837	0.842
0.0089	0.0089	0.0089	0.0089	0.0089	0.0089
0.00827	0.00837	0.00837	0.00837	0.00837	0.00837
0.0084	0.0084	0.0084	0.0084	0.0084	0.0084
0.00842	0.00842	0.00842	0.00842	0.00842	0.00842
N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

SURSYSTEM SUMMARY:

LOAD	HOT WATER	HEATING	COOLING	SOLAR FRACTION	SOLAR ENERGY USED	OPERATING ENERGY	AUX. THERMAL ENRG	AUX. ELECTRIC FUEL	AUX. FOSSIL FUEL	ELECTRICAL SAVINGS	FOSSIL SAVINGS
52.099	45.167	4.007	71.415	4.007	71.415	71.415	11.068	16.121	16.121	2.116	2.116
8	0	0	0	6.8	6.8	6.8	0.500	0.572	0.572	0.000	0.000
PFC FCT	C	C	C	6.8	6.8	6.8	1.900	1.900	1.900	N.A.	N.A.
				6.8	6.8	6.8	1.900	1.900	1.900	N.A.	N.A.

SYSTEM PERFORMANCE FACTOR:

0.179

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,
SOLAR/0004-78/18

SOLAR/2017-79/04

ENERGY COLLECTION AND STANDALONE SUBSYSTEM (ECS)

SITE: ALABAMA POWER COMPANY, MONTevallo, AL
REPORT PERIOD: APRIL, 1979

סולאר/ 2017-70/04

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-E	ENERGY TC LCA DS MILLION BTU	AUX THEMAL TO ECSS MILLION BTU		NCT APPLIABLE	ECSS OPERATING ENERGY MILLION BTU	ECSS ENPCV REFJECTED MILLION BTU	NCT APPLIABLE	ECSS SOLAR CONVECTION EFFICIENCY
				ECSS OPERATING ENERGY MILLION BTU	ECSS ENPCV REFJECTED MILLION BTU					
1	2.937	69	0.030	0.000	0.000	NCT	0.000	0.000	NCT	0.010
2	0.736	67	0.035	0.000	0.000		0.000	0.000		0.048
3	2.786	60	0.046	0.000	0.000		0.000	0.000		0.016
4	3.056	62	0.092	0.024	0.000		0.000	0.000		0.020
5	6.38	55	0.036	0.000	0.000		0.000	0.000		0.006
6	5.434	57	0.548	0.000	0.000		0.000	0.000		0.006
7	5.149	62	0.000	0.000	0.000		0.000	0.000		0.006
8	1.036	60	0.000	0.000	0.000		0.000	0.000		0.006
9	4.214	55	0.000	0.000	0.000		0.000	0.000		0.006
10	4.221	73	0.000	0.000	0.000		0.000	0.000		0.006
11	2.899	64	0.000	0.000	0.000		0.000	0.000		0.006
12	2.0268	64	0.000	0.000	0.000		0.000	0.000		0.006
13	1.436	64	0.000	0.000	0.000		0.000	0.000		0.006
14	5.636	61	0.000	0.000	0.000		0.000	0.000		0.006
15	5.450	62	0.000	0.000	0.000		0.000	0.000		0.006
16	4.701	61	0.000	0.000	0.000		0.000	0.000		0.006
17	4.987	65	0.000	0.000	0.000		0.000	0.000		0.006
18	4.671	67	0.000	0.000	0.000		0.000	0.000		0.006
19	4.028	69	0.000	0.000	0.000		0.000	0.000		0.006
20	4.832	67	0.000	0.000	0.000		0.000	0.000		0.006
21	4.11075	66	0.000	0.000	0.000		0.000	0.000		0.006
22	1.607	67	0.000	0.000	0.000		0.000	0.000		0.006
23	1.633	67	0.000	0.000	0.000		0.000	0.000		0.006
24	1.071	64	0.000	0.000	0.000		0.000	0.000		0.006
25	0.820	62	0.000	0.000	0.000		0.000	0.000		0.006
26	2.946	66	0.000	0.000	0.000		0.000	0.000		0.006
27	5.072	59	0.198	0.000	0.000		0.000	0.000		0.030
28	5.217	57	0.561	0.000	0.000		0.000	0.000		0.108
29	3.017	55	0.755	0.000	0.000		0.000	0.000		0.103
30	5.193	53	0.112	0.000	0.000		0.000	0.000		0.022
SUM	102.658	-	3.893	N.A.	1.537	N.A.	-	-	-	-
AVG	3.422	63	0.130	N.A.	0.051	N.A.	0.038	N.A.	0.038	N.A.
NBS ID	0001	N113	0.102							

* DENOTES UNAVAILABLE DATA

NOTES: DENOTES A VARIABLE THAT IS AVAILABLE ONLY IF THE INDIVIDUAL IS A MEMBER OF A HOUSEHOLD.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCESITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL, 1979

SOLAR/2017-79/04

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	COLLECTOR ARRAY EFFICIENCY	DAYTIME AMBIENT TEMP DEG E	71	71
						71	71
1	2.937	0.000	0.000	0.000	69	69	69
2	2.736	0.000	0.000	0.000	57	57	57
3	2.786	0.745	0.511	0.511	66	66	66
4	3.056	2.033	0.278	0.278	54	54	54
5	5.638	2.969	2.168	2.168	67	67	67
6	5.434	2.000	1.000	1.000	71	71	71
7	5.149	0.000	0.000	0.000	54	54	54
8	1.036	3.432	0.840	0.840	61	61	61
9	4.214	3.811	0.850	0.850	59	59	59
10	4.221	2.528	0.525	0.525	76	76	76
11	2.980	2.005	0.005	0.005	61	61	61
12	2.68	0.025	0.025	0.025	74	74	74
13	1.436	0.000	0.000	0.000	73	73	73
14	5.636	0.000	0.000	0.000	-0.043	-0.043	-0.043
15	5.450	4.701	4.424	4.424	75	75	75
16	4.701	4.987	4.000	4.000	70	70	70
17	4.987	4.671	0.001	0.001	*	*	*
18	4.671	4.028	1.23	1.23	2.04	2.04	2.04
19	4.028	4.822	0.000	0.000	-0.344	-0.344	-0.344
20	4.822	1.075	0.001	0.001	-0.540	-0.540	-0.540
21	1.075	1.607	0.001	0.001	-0.000	-0.000	-0.000
22	1.607	1.633	0.341	0.341	-0.344	-0.344	-0.344
23	1.633	1.671	0.341	0.341	-0.540	-0.540	-0.540
24	1.671	0.820	0.350	0.350	-0.206	-0.206	-0.206
25	0.820	2.946	0.709	0.709	62	62	62
26	2.946	5.072	4.628	4.628	55	55	55
27	5.072	5.211	0.000	0.000	62	62	62
28	5.211	3.017	0.000	0.000	61	61	61
29	3.017	5.103	4.845	4.845	70	70	70
30	5.103	1.026	1.949	1.949	0.374	0.374	0.374
SUM		102.658	29.779	12.987	-	-	-
AVG		3.422	1.326	0.433	66	66	66
NBSID		Q001	Q100	Q100	N100	N100	N100

* DENOTES UNAVAILABLE DATA.

@ DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCESITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL, 1979

SNLAP/2017-70/04

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STOR- AGE ENERGY MILLION BTU	STOR- AGE AV- EDAGE TEMP DEG F	STOR- AGE EFFI- CIENCY
				1000	1000
1	0.000	0.020	-0.004	101.99	
2	0.000	0.025	-0.001	100.98	
3	0.566	0.046	-0.525	96.97	
4	2.270	0.147	-1.925	90.97	
5	2.215	0.037	-1.978	91.94	
6	0.490	0.000	-0.340	90.95	
7	2.000	0.000	-1.996	90.95	
8	0.861	0.020	-0.841	90.95	
9	2.061	0.306	-1.755	90.95	
10	2.032	0.234	-1.798	90.95	
11	2.432	0.234	-1.998	90.95	
12	0.000	0.000	-0.000	90.95	
13	0.000	0.000	-0.000	90.95	
14	0.000	0.000	-0.000	90.95	
15	1.678	0.000	-1.678	90.95	
16	1.678	0.000	-1.678	90.95	
17	1.678	0.000	-1.678	90.95	
18	2.040	0.379	-1.661	90.95	
19	2.068	0.111	-1.957	90.95	
20	1.557	0.084	-1.473	90.95	
21	1.600	0.000	-1.600	90.95	
22	0.000	0.000	-0.000	90.95	
23	0.000	0.000	-0.000	90.95	
24	0.000	0.000	-0.000	90.95	
25	0.000	0.000	-0.000	90.95	
26	0.981	0.154	-0.827	90.95	
27	1.637	0.279	-1.358	90.95	
28	0.000	0.561	-0.561	90.95	
29	0.000	0.755	-0.755	90.95	
30	1.948	0.120	-1.828	90.95	
SUM	15.210	6.269	-9.941	90.95	
Avg	0.507	0.209	-0.070	90.95	
NRS ID	Q200	Q201	Q202	N108	

* DENOTES UNAVAILABLE DATA.

@ DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HCT WATER SUBSYSTEMSITE: ALABAMA POWER COMPANY, MONTEVALLO, AL
REPORT PERIOD: APRIL, 1979

SOLAR/2017-70/04

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR ENRGY FR. OF LOAD MILLION BTU	OPER. ENRGY USED MILLION BTU	AUX THERMAL USED MILLION BTU	SUP. WATER USED GAL		HOT WATER TEMP. DEG F		HOT WATER TEMP. DEG F		SUP. WATER USED GAL	
					APR QT	APR LT	APR LT	APR LT	APR LT	APR LT	APR LT	APR LT
1	0.030	100	0.030	0.023	0.000	0.000	105	105	105	105	105	105
2	0.034	100	0.034	0.023	0.000	0.000	105	105	105	105	105	105
3	0.046	100	0.046	0.023	0.000	0.000	105	105	105	105	105	105
4	0.064	24	0.009	0.016	0.000	0.000	105	105	105	105	105	105
5	0.034	100	0.034	0.023	0.000	0.000	105	105	105	105	105	105
6	0.025	100	0.025	0.021	0.000	0.000	105	105	105	105	105	105
7	0.019	100	0.019	0.025	0.000	0.000	105	105	105	105	105	105
8	0.025	100	0.025	0.026	0.000	0.000	105	105	105	105	105	105
9	0.022	100	0.022	0.026	0.000	0.000	105	105	105	105	105	105
10	0.025	100	0.025	0.026	0.000	0.000	105	105	105	105	105	105
11	0.020	100	0.020	0.026	0.000	0.000	105	105	105	105	105	105
12	0.025	100	0.025	0.026	0.000	0.000	105	105	105	105	105	105
13	0.022	100	0.022	0.026	0.000	0.000	105	105	105	105	105	105
14	0.025	100	0.025	0.026	0.000	0.000	105	105	105	105	105	105
15	0.027	100	0.027	0.026	0.000	0.000	105	105	105	105	105	105
16	0.028	100	0.028	0.026	0.000	0.000	105	105	105	105	105	105
17	0.027	100	0.027	0.026	0.000	0.000	105	105	105	105	105	105
18	0.028	100	0.028	0.026	0.000	0.000	105	105	105	105	105	105
19	0.029	100	0.029	0.026	0.000	0.000	105	105	105	105	105	105
20	0.028	100	0.028	0.026	0.000	0.000	105	105	105	105	105	105
21	0.024	100	0.024	0.026	0.000	0.000	105	105	105	105	105	105
22	0.029	100	0.029	0.027	0.000	0.000	105	105	105	105	105	105
23	0.027	100	0.027	0.027	0.000	0.000	105	105	105	105	105	105
24	0.034	100	0.034	0.027	0.000	0.000	105	105	105	105	105	105
25	0.040	100	0.040	0.027	0.000	0.000	105	105	105	105	105	105
26	0.026	100	0.026	0.027	0.000	0.000	105	105	105	105	105	105
27	0.040	100	0.040	0.027	0.000	0.000	105	105	105	105	105	105
28	0.019	100	0.019	0.027	0.000	0.000	105	105	105	105	105	105
29	0.034	100	0.034	0.027	0.000	0.000	105	105	105	105	105	105
30	0.024	100	0.024	0.027	0.000	0.000	105	105	105	105	105	105
SUM	0.934	-	0.135	0.084	0.793	0.793	N.A.	N.A.	0.135	N.A.	-	N.A.
AVG	0.031	15	0.004	0.003	0.026	0.026	N.A.	N.A.	0.004	N.A.	103	N.A.
NBS	Q302	N300	Q300	Q303	Q305	Q305	Q311	Q313	N305	N307	N308	N307

* DENOTES UNAVAILABLE DATA.

@ DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEMSITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL, 1979

SOLAR/2017-79/04

DAY OF MON.	SPACE HEATING LOAD BTU	SOLAR FR. OF LOAD PCT	SOLAR ENERGY USED BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	PLNG AMR TEMP TEMP DEG. F	PLNG AMR TEMP TEMP DEG. F
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	69	69
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	67	67
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	60	60
4	100	0.83	83	0.015	0.000	0.000	0.000	0.000	76	76
5	0.000	0.000	0.000	130	0.036	0.000	0.000	0.000	62	55
6	0.000	0.000	0.000	111	0.042	0.000	0.000	0.000	75	57
7	0.000	0.000	0.000	114	0.041	0.000	0.000	0.000	70	62
8	0.000	0.000	0.000	105	0.051	0.000	0.000	0.000	75	67
9	0.000	0.000	0.000	133	0.029	0.000	0.000	0.000	57	55
10	0.000	0.000	0.000	114	0.026	0.000	0.000	0.000	76	73
11	0.000	0.000	0.000	126	0.026	0.000	0.000	0.000	64	64
12	0.000	0.000	0.000	111	0.026	0.000	0.000	0.000	76	76
13	0.000	0.000	0.000	133	0.026	0.000	0.000	0.000	64	64
14	0.000	0.000	0.000	114	0.025	0.000	0.000	0.000	61	61
15	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	65	65
16	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	70	70
17	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	61	61
18	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	65	65
19	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	67	67
20	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	67	67
21	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	67	67
22	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	66	66
23	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	67	67
24	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	62	62
25	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	76	76
26	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	66	66
27	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	77	77
28	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	58	58
29	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	78	78
30	0.000	0.000	0.000	125	0.025	0.000	0.000	0.000	55	55
SUM	5.254	-	3.561	1.072	1.693	1.707	N.A.	3.464	N.A.	-
Avg	0.175	68	0.119	0.036	0.056	0.057	N.A.	C.115	N.A.	77
NBS	Q402	N400	Q400	Q403	Q401	Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.

@ DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.

SOIAB HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE COUNTING SUBSYSTEM

SITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL 1979

* * DENOTES UNAVAILABLE DATA.
 @ DENOTES NULL DATA.
 N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARYSITE: ALABAMA POWER COMPANY, MONTevallo, AL
REPORT PERIOD: APRIL, 1970

SOLAR/2017-79/04

DAY OF MONTH	TOTAL INSOLATION BTU/SQ. FT	DIFFUSE INSOLATION BTU/SQ. FT	AMBIENT TEMP DEG. F	DAYTIME AMBIENT TEMP DEG. F		WIND DIRECTION DEGREES	WIND SPEED M.P.H.
				RELATIVE HUMIDITY PERCENT	DESP. E		
1	1255	N	69	71	69	N	C
2	1315	Q	67	69	57	Q	A
3	1191	Q	60	62	66	Q	P
4	1306	A	55	57	58	A	P
5	2409	P	57	57	67	P	P
6	2322	P	62	62	71	L	L
7	2200	L	57	54	54	I	C
8	443	C	60	61	50	C	A
9	1801	A	55	55	76	A	L
10	1804	R	72	72	61	R	L
11	1235	R	64	64	64	R	L
12	1115	R	61	61	71	R	L
13	614	R	62	62	74	R	L
14	2409	R	61	61	73	R	L
15	2329	R	65	67	71	R	L
16	22009	R	67	67	75	R	L
17	2131	R	67	67	70	R	L
18	1196	R	67	67	68	R	L
19	11722	R	67	67	64	R	L
20	2065	R	67	66	62	R	L
21	459	R	66	67	70	R	L
22	687	R	67	67	70	R	L
23	698	R	67	67	70	R	L
24	458	R	64	64	70	R	L
25	354	R	62	62	61	R	L
26	1259	R	66	66	60	R	L
27	12167	R	57	57	70	R	L
28	2227	R	55	55	70	R	L
29	11674	R	63	63	70	R	L
30	2219	R	—	—	—	R	L
SUM	43871	N.A.	—	—	—	—	—
Avg	1462	N.A.	63	66	N.A.	N.A.	N.A.
NBS ID	Q001	N113	N115	N114	N114	N114	N114

* DENOTES UNAVAILABLE DATA.

@ DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
THERMODYNAMIC CONVERSION EQUIPMENT
SITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL, 1979

DAY OF MONTH	EQUIPMENT LOAD MILLION BTU	THERMAL ENERGY INPUT MILLION BTU	OPERATING ENERGY MILLION BTU	ENERGY REJECTED MILLION BTU	COEFFICIENT OF PERFORMANCE (SEE NOTE)
					SOLAR/2017-70/04
1	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	*
17	0.000	0.000	0.000	0.000	*
18	0.000	0.000	0.000	0.000	*
19	0.000	0.000	0.000	0.000	*
20	0.000	0.000	0.000	0.000	*
21	0.000	0.000	0.000	0.000	*
22	0.000	0.000	0.000	0.000	*
23	0.000	0.000	0.000	0.000	*
24	0.000	0.000	0.000	0.000	*
25	0.000	0.000	0.000	0.000	*
26	0.000	0.000	0.000	0.000	*
27	0.000	0.000	0.000	0.000	*
28	0.000	0.000	0.000	0.000	*
29	0.000	0.000	0.000	0.000	*
30	0.000	0.000	0.000	0.000	*
SUM	0.005	0.002	0.002	0.003	0.058
Avg	0.000	0.003	0.000	0.000	0.002

* DENOTES UNAVAILABLE DATA.

@ DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.

NOTE:

SCLAP HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
AUXILIARY STORAGE PERFORMANCESITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL, 1979

SCLAP/2017-79/04

DAY OF MONTH	ENERGY IN STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	INCREASE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DFG E	STORAGE EFFICIENCY		
					100	100	100
1	0.105	0.000	0.105	46	0.302	0.68	0.358
2	0.000	0.658	-0.658	45	0.026	0.006	0.029
3	0.040	0.210	-0.020	45	-0.000	0.000	0.074
4	0.071	0.222	-0.021	45	-0.006	0.006	0.000
5	0.000	0.195	-0.195	44	-0.020	0.020	0.000
6	0.053	0.272	-0.219	44	-0.000	0.000	0.000
7	0.020	0.000	-0.020	45	-0.000	0.000	0.000
8	0.023	0.000	-0.023	47	-0.000	0.000	0.000
9	0.023	0.136	-0.113	45	-0.000	0.000	0.000
10	0.023	0.217	-0.194	45	-0.000	0.000	0.000
11	0.023	0.422	-0.399	45	-0.000	0.000	0.000
12	0.001	0.243	-0.242	45	-0.000	0.000	0.000
13	0.029	0.298	-0.269	45	-0.000	0.000	0.000
14	0.028	0.000	-0.028	45	-0.000	0.000	0.000
15	0.027	0.000	-0.027	47	-0.000	0.000	0.000
16	**	**	**	**	**	**	**
17	**	**	**	**	**	**	**
18	0.120	0.235	-0.115	44	0.057	0.269	0.254
19	0.019	0.398	-0.380	44	-0.000	0.000	0.000
20	0.020	0.000	-0.020	44	-0.000	0.000	0.000
21	0.030	0.000	-0.030	46	-0.000	0.000	0.000
22	0.088	0.411	-0.323	45	-0.000	0.000	0.000
23	0.000	0.350	-0.350	45	-0.000	0.000	0.000
24	0.000	0.187	-0.187	45	-0.000	0.000	0.000
25	0.050	0.000	-0.050	45	-0.000	0.000	0.000
26	0.192	0.000	-0.192	45	-0.000	0.000	0.000
27	0.574	0.000	-0.574	45	-0.000	0.000	0.000
28	0.044	0.000	-0.044	45	-0.000	0.000	0.000
29	0.000	0.153	-0.153	45	-0.000	0.000	0.000
30	0.043	0.000	-0.043	45	-0.000	0.000	0.000
SUM	3.240	6.685	-3.449	-	-	-	-
Avg	0.111	0.223	0.015	48	0.015	0.423	0.423

* DENOTES UNAVAILABLE DATA.

** DENOTES NULL DATA.
N/A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
AUXILIARY THERMODYNAMIC CONVERSION EQUIPMENT

SITE: ALABAMA POWER COMPANY, MONTGOMERY, AL
REPORT PERIOD: APRIL, 1979

SOLAR/2017-70/04

DAY OF MONTH	EQUIPMENT LOAD MILLION BTU	THERMAL ENERGY INPUT MILLION BTU	OPERATING ENERGY MILLION BTU	COEFFICIENT OF PERFORMANCE (SEE NOTE)	
				ENERGY REFUSED MILLION BTU	PERFORMANCE INDEX
1	0.000	0.000	1.359	0.000	0.000
2	2.749	0.815	1.823	2.743	3.372
3	1.674	0.596	1.860	1.743	2.792
4	1.732	0.594	1.920	1.757	2.915
5	1.707	0.588	1.924	1.774	2.903
6	1.814	0.608	1.927	1.866	2.984
7	1.000	0.600	1.617	0.000	0.000
8	1.512	0.527	1.637	0.000	0.000
9	1.937	0.640	1.874	1.551	2.866
10	1.951	0.640	1.940	2.015	3.027
11	1.147	0.828	1.896	2.805	3.566
12	1.147	0.696	1.964	2.148	3.077
13	1.987	0.598	1.967	1.876	2.154
14	1.000	0.000	1.637	0.000	0.000
15	1.000	0.000	1.627	0.000	0.000
16	*	*	*	*	*
17	*	*	*	*	*
18	2.074	0.696	2.055	2.135	2.977
19	2.342	0.672	2.31	2.226	3.483
20	2.000	0.970	1.637	0.000	0.000
21	0.804	0.296	1.738	0.783	2.718
22	2.452	0.760	1.976	2.476	3.228
23	2.348	0.785	2.015	2.401	3.001
24	2.564	0.562	2.1790	1.626	2.785
25	1.079	0.070	1.716	-0.101	0.000
26	1.259	0.070	1.937	1.196	4.613
27	1.000	0.000	1.637	0.000	0.000
28	0.990	0.000	1.627	0.000	0.000
29	3.936	1.040	1.965	3.939	3.788
30	*	*	*	*	*
SUM	41.042	12.865	54.502	41.173	-
Avg	1.368	0.429	1.817	1.372	3.190

* DENOTES UNAVAILABLE DATA.

② DENOTES NULL DATA.

N.A. DENOTES NOT APPLICABLE DATA.
NOTE:



UNIVERSITY OF FLORIDA



3 1262 09052 6947